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ABSTRACT

This booklet is the second of three sequels to "A Guide to the Selection of Instructional Methods." Following a brief introduction, the characteristics, strengths, and weaknesses of five individualized learning techniques are examined: (1) directed study of material in textbooks; (2) study of specially-prepared hand-out notes or programmed texts; (3) self-instruction via audiovisual media; (4) computer-based learning; and (5) individual practical, studio, or project work. Contexts in which individualized learning can be used are then discussed, including its role in conventional "taught" courses, in personalized systems of instruction such as the Keller Plan, in flexible- and open-learning systems, in distance learning systems, and in equalization and remedial work. An annotated list of six items recommended for further reading is included. (MES)

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A Guide to the Use of Individualised Learning Techniques

Introduction

This booklet and the two other booklets that accompany it ("A guide to the use of mass instruction techniques" and "A guide to the use of group learning techniques") are sequels to booklet number 2 in this series, "A guide to the selection of instructional methods", which it is suggested should be read *before* the present booklet.

In "A guide to the selection of instructional methods", it is shown how the selection of appropriate instructional methods should be the second key step in any systematic approach to course or curriculum design, following the formulation of the instructional aims and objectives (see booklet on "Educational objectives"). It is also shown how instructional methods can be divided into three broad groups, namely *mass instruction techniques, individualised learning techniques and group learning techniques*. In this booklet, we will take a much more detailed look at the second of these three groups, namely, *individualised learning techniques*. First, we will examine some of the most widely used individualised learning techniques, identifying their main characteristics and discussing their respective strengths and weaknesses. Then we will take a look at some of the contexts in which individualised learning can be used, discussing its role in conventional 'taught' courses, in personalised systems of instruction such as Keller plan, in flexible- and open-learning systems, in distance-learning systems and in equalisation and remedial work.

The main individualised learning techniques

In this section, we will discuss five of the most common methods that are used in individualised learning situations, namely *directed study of material in textbooks, study of specially-prepared hand-out notes or programmed texts, self-instruction via audiovisual media, computer-based learning* and *individual practical, studio or project work*. Within each of these categories, it is, of course, possible to adopt a wide range of approaches and tactics, but, as we will see, it is also possible to make a number of generalisations, and it is on these that we will concentrate.

Directed study of material in textbooks

Conventional text books can often be used in self-instructional situations, although, by themselves, they may not necessarily be suitable for enabling *mastery* of desired material to be achieved. This is because most textbooks are designed simply to *present* information, not to provide the users with a systematic learning programme. Also, it is very rare to find a single textbook that covers all the material in a course or module in the manner that the person responsible for teaching that course or module requires. The effectiveness of textbooks as vehicles for self-instruction can, however, generally be greatly increased by the use of a suitable *study guide* which structures the learning process for the students by directing them to suitable chapters (or sections thereof) in appropriate books in a systematic and cumulative way, provides supplementary notes and assignments, etc.

Some strengths of directed study of textbook material

(i) In the case of certain core subject areas, the course material may well be adequately covered in normal textbooks, and, if so, such books represent one of the cheapest and most convenient forms of self-instructional materials. Provided that suitable texts are available and the work is carefully structured, directed study of such textbooks can be a highly effective way of teaching basic facts, principles, applications, etc., i.e. of achieving objectives mainly of the *lower cognitive* type.

(ii) Directed study of this type has the great advantage of allowing each learner to work at his or her natural pace. Research has shown that learners differ considerably in the rate at which they can assimilate new material effectively, so *any* method that allows self-pacing to take place is almost invariably more effective than a method (like the lecture) in which they all have to work at the pace directed by the instructor.

(iii) Another great advantage of the method is that it requires no specialised hardware or other facilities, and no specialised courseware other than standard textbooks. The latter can either be purchased by the students or made available through a suitable library.

(iv) A further advantage of the method is that study can be carried out at any time suitable to the learner, and (provided that the textbooks involved are not restricted to 'reference only' use within a library) at any convenient place.

Some weaknesses of the method

(i) One possible disadvantage of the method is that it requires extremely careful planning and structuring on the part of the supervising teacher if it is to be fully effective; this, obviously, requires both skill and time.

(ii) Also, the method is totally dependant on suitable texts being available. In some cases, it may be possible to insist that all students purchase their own copies of the book or books involved, but, in many cases, this will not be a realistic option. In such cases, it will be necessary to ensure that the books are available in the library in sufficient numbers to enable *all* the students in the class to have suitable access. Ideally, this should be done by purchasing multiple copies and making them available for borrowing, but, if this is not possible, the books should be made available on a 'reference only' basis, for use in the actual library.

(iii) The method is not really suitable for achieving many *higher cognitive* and *non-cognitive* objectives.

(iv) Unless a deliberate attempt is made to build in participative student activities through the study guide, study of material in textbooks can be a very passive form of study, with little or no interaction taking place between the learner and the learning materials; this can lead to boredom and lack of motivation on the part of the students.

Study of specially-prepared hand-out notes or programmed texts

One of the drawbacks of using textbooks in self-instructional situations is that they may well be inappropriate either in terms of their level or in terms of their treatment of the subject matter, thus making it unlikely that they will match the objectives of the course and meet the requirements of the students. Use of carefully-prepared and structured *hand-out notes* produced by the teaching staff offer one means of getting round this difficulty, although the problem of low student interaction with the material may still be present unless deliberate steps are taken to counteract it.

One way of increasing student interaction with textual materials of this type is to produce the notes in the form of a *programmed text*. This involves structuring the material in a series of comparatively small, easily-digestible *steps* (or frames) and interspersing those that merely present information (*teaching frames*) with others that require active participation on the part of the learner (e.g. *practice frames*, which provide practice in the material just presented, or *test*

frames, which determine whether the learner has mastered the material).

There are two basic ways in which such programmed learning materials can be structured, namely, in the form of a *linear programme* and in the form of a *branching programme*. *Linear programmes* were first developed in the mid-1950's, and were based on the *stimulus-response model of learning* that had been developed by the behavioural psychologist, B F Skinner. In such a programme there is only one possible path through the material, leading directly from the starting point (the learner's pre-knowledge) to the end point (the instructional goal established for the programme) by a linear sequence of frames, as shown in figure 1.

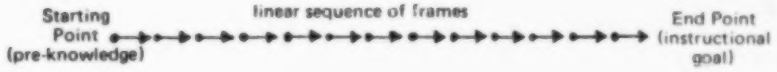

Figure 1: the basic structure of a linear programme

Branching programmes, which were first used in the early 1960's differ from linear programmes in that they allow the learner to progress through the sequence of frames in a number of different ways, with the exact path depending on his or her performance. Some of the basic structural features that can be incorporated in such a branching programme are shown in figure 2.

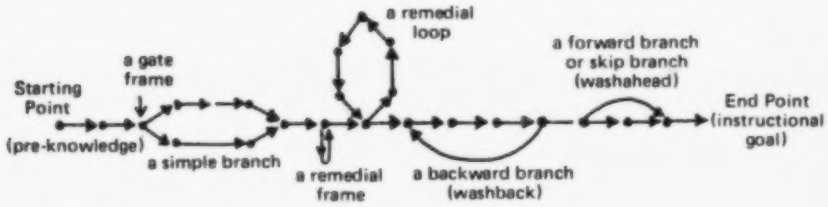

Figure 2: some of the elements that can be built into a branching programme

Basic guidance on how to write self-instructional programmed texts is given in a separate booklet ("Writing programmed learning materials"); more detailed guidance can be found in the booklet by

Megarry that is listed in the "Further Reading" section at the end of this booklet.

Some strengths of specially-prepared notes and programmed texts

(i) As a learning method, study of specially-prepared handout notes and programmed texts has all the basic educational advantages of directed study of material in textbooks, and, if the material is well designed, can be an extremely effective method of achieving a wide range of (mainly) lower-cognitive objectives.

(ii) If the material incorporates a high degree of learner participation, this added dimension can make the method even more effective.

Some weaknesses of the method

(i) The main disadvantage of the method is that the task of producing *effective* materials is inevitably extremely time-consuming, and also requires a great deal of skill on the part of the writer. This is doubly true in the case of fields (such as electronics and computer science) that are in a more-or-less continuous state of change, since writers of individualised learning materials in such fields are faced with the on-going problem of keeping their material up to date; indeed they can be faced with a never-ending task rather akin to painting the Forth Bridge!

(ii) Another major limitation of the method is that, like directed study of textbook material, it is not really suitable for achieving a wide range of higher cognitive and non-cognitive objectives.

(iii) A third disadvantage of the method is that it can become extremely boring to students if it is over-used, e.g. if it is the *only* method employed to cover a large section of a syllabus. Because of this, many modern programmed learning sequences that are based primarily on textual materials incorporate some audiovisual or computer-based learning materials as well in order to help maintain student interest and motivation.

Self-instruction via audiovisual media

Although print-based self-instructional material still has an important place in most individualised learning systems, many self-instructional learning packages now utilize a whole range of audio and visual media to increase their impact and effectiveness. Such packages may include audiotapes, videotapes, filmstrips, loop films, slide

sequences, large transparencies, models, practical kits, tools and instruments as well as conventional printed material, the particular 'media mix' being carefully chosen with the objectives of the topic being covered in mind. For example, in a number of individualised learning packages that have been developed at Glasgow University to teach three-dimensional structures and relationships, print material, audiotapes and slides have been used in conjunction with custom-built three dimensional models and construction kits; using the latter, students can build and examine their own models as directed by the programme. The precise choice of media is therefore very dependent on the objectives that the package is designed to achieve, the full range that is available being described in another booklet in this series ("A review of the different types of instructional materials available to teachers and lecturers").

Some strengths of self-instruction via audiovisual materials

(i) Because of the wide range of media available, audiovisual self-instructional materials can be used to achieve a wide range of educational objectives, and although these again tend to fall mainly in the lower cognitive range, it is also possible to use them to achieve other types of objectives. By associating manipulative tasks with such materials, for example, they can be used to develop certain types of *psychomotor skills*, and they can also be highly effective in achieving certain types of affective objectives (e.g. in producing desirable attitude changes).

(ii) Like the other types of self-instructional materials described in this booklet, they also have the great advantage of allowing the learner to work at his or her own pace.

(iii) In some cases (e.g. language laboratories, or the tape-model systems developed at Glasgow University), they allow a high element of learner participation to be built into the learning process – another important educational 'plus'.

(iv) Use of appropriate media enables things like sound, movement and realism to be introduced into a presentation, thus increasing student interest and motivation.

(v) Use of well-designed mediated presentations can save instructors from having to carry out a great deal of time-consuming, repetitive work – e.g. in teaching all the members of a class individually how to use a particular type of machine, instrument or tool or how to carry out a particular process.

Some weaknesses of the audiovisual approach

(i) The main weakness of the approach is that suitable ready-made courseware is seldom available, so that the instructor has to produce his-her own. This is invariably time-consuming, often expensive, and (in many cases) requires specialist skills that the average teacher or lecturer simply does not possess. In some cases, it may be possible to learn the required skills by undergoing suitable staff development (e.g. learning basic video production skills), but in other cases it may be necessary to rely on specialist support staff.

(ii) Although mediated self-instruction can be used to achieve a somewhat wider range of objectives than self-instruction based purely on the study of textual materials, there are still a wide range of higher-cognitive and non-cognitive objectives for which the technique is inappropriate.

(iii) By its very nature, mediated self-instruction relies totally on the availability of suitable hardware. In many cases, provision of sufficient hardware to enable extensive use of the method to take place may simply not be possible because of its cost, or due to lack of space for the provision of suitable study stations (*carrels*).

Computer-based learning

It has been claimed that the development of the modern digital computer and its use in the various forms of *computer-based learning* constitutes the most important development in educational technology since the invention of the moveable-type printing press back in the 15th Century. Whether or not this is the case, there can be no doubt that the computer has the *potential* to make a tremendous impact on educational practice, particularly in the field of self-instruction. The various uses of the computer in education are examined in detail in a separate booklet ("How computers can be used in education"), so we will limit ourselves here to a brief general discussion of the strengths and weaknesses of computer-based learning.

Some strengths of computer-based learning

(i) Whether it is employed in the 'substitute-tutor' mode or in the 'simulated laboratory' mode (see "How computers can be used in education" for details of these), use of the computer as a delivery system for self-instructional materials enables an extremely wide range of educational objectives to be achieved, although (as with other types of self-instructional system) these tend to fall mainly in the lower cognitive area.

(ii) Use of a computer as a delivery system again enables each learner to work at his/her own natural pace.

(iii) Possibly the greatest strength of the computer as a delivery system is that it enables an extremely high degree of learner participation to be built into the instructional process, and also enables the system to adapt to the needs of the individual learner in a way that is simply not possible with other delivery systems.

(iv) Use of the computer can provide (through computer simulations) a wide range of otherwise inaccessible learning experiences. It can, for example, enable learners to carry out simulated experiments in fields like human genetics, macro-economics and sociology where actual experiements are impossible for ethical, economic or practical reasons.

(v) A further advantage of using a computer as a delivery system for self-instructional materials is that it allows on-going assessment and monitoring to take place automatically if this is thought appropriate. This can be extremely useful, especially if the learner is working in isolation (e.g. on a distance learning course).

Some weaknesses of computer-based learning

(i) Computer-based learning has the same basic weaknesses as mediated self-instruction in terms of general lack of availability of suitable ready-made courseware, total dependence on the availability of appropriate hardware and the fact that it is not suitable for use in achieving a wide range of higher-cognitive and non-cognitive objectives.

(ii) A further weakness specific to computer-based learning is that it requires computer literacy and (in many cases) a degree of programming skill on the part of the person designing the materials. With the development of user-friendly *authoring systems* of ever-increasing sophistication, however, it is now becoming very much easier for non-programmers to write CBL materials than was the case in the past, when ability to write programs in a language such as BASIC or FORTRAN was an absolute necessity for such work.

Individual practical, studio or project work

Work of this type certainly constitutes an important individualised learning technique, and has therefore been included in this booklet for completeness. Apart from the added advantage of allowing learners to work at their own pace, however, such work has the same basic characteristics, strengths and weaknesses as the mass

practical and studio work that is discussed in "A guide to the use of mass instruction techniques", and the interested reader is therefore referred to this other booklet.

The different contexts in which individualised learning can be used

As is shown in "A guide to the selection of instructional methods", individualised learning (in the form of correspondence courses and similar systems) has been around for a very long time, but has only been part of "mainstream' educational methodology since Skinner's work on behavioural psychology triggered off the *programmed learning* movement that so dominated progressive educational thinking during the 1960's. Since then, individualised learning has been used in a wide variety of contexts, some of the more important of which will now be examined

Use of individualised learning in a conventional 'taught' course or module

Despite the move towards student-centred learning that has taken place during the last 25 years or so, the great majority of the courses in Britain's colleges and universities are still run on traditional lines, with most of the formal teaching consisting of systematic programmes of lectures backed up with appropriate tutorials, seminars and practical work and little or no use being made of individualised learning. There are, however, occasions when an element of individualised learning can usefully be incorporated into such a conventional course or module, and the good lecturer should always be on the lookout for places where its use could possibly lead to more effective learning on the part of the students or more efficient use of his or her own time.

One obvious way in which a lecturer can often achieve both of these objectives is replacement of some of the lectures in a course by self-study by the students of some of the material that would have been covered in these lectures. In most courses, there is a large body of largely factual material that can often be taught just as effectively by self-study as by expository teaching, and, by using such individualised study methods, the lecturer concerned can not only reduce his or her class contact time but also make it easier for most of the students to master the material. It is also one way in which greater student autonomy and responsibility for learning can be developed. After all, most post-college learning is self-learning!

Another way in which an element of self-instruction can often be built into a conventional taught course is as a component of laboratory or

studio work. It is, for example, often possible to provide individual instruction to students on how to operate a particular item of equipment, how to carry out a particular manipulative process, etc by producing a suitable self-instructional programmed based on (say) a video presentation or a tape-slide programme. Appropriate use of such materials can sometimes save greatly on staff time.

Use of individualised learning
in a personalised system of instruction such as Keller Plan

In some cases, it may be advantageous to organise an entire section or module of a course in the form of a *personalised system of instruction (or PSI)* or some sort. Such an approach is particularly cost effective in cases where only a few students are undertaking the section or module in question (e.g. as an optional module within an honours degree), since it can then significantly reduce the class contact time of the member(s) of staff responsible for teaching the material. For the benefit of those who have little or no experience of operating this type of student-centred learning system, we will now take a detailed look at one of the most popular personalised systems of instruction - Keller Plan. This was developed by Professor F S Keller of Columbia University in the late 1960's, and is a good example of the way in which student centred learning can be used within the context of an otherwise conventional institution-centred course.

In the Keller Plan, the course material to be covered is divided into a number of units, each with specified learning objectives, and the students receive a detailed *study guide* which suggests a number of possible means of achieving these objectives. Armed with this information, students work largely on their own, using a range of appropriate self-instructional materials. The study guide leads students through set textbooks, and contains supplementary notes, worked exercises, assignments etc. Some units may also incorporate learning aids such as tape-slide programmes, loop films, models, CBL materials, and other structured learning materials specially prepared for use in the course. Typically, each unit represents roughly one week's work for an 'average' student, but, as students work at their own pace, this is variable. The student is free to discuss problems associated with the unit with his or her tutor at any time. For this reason, tutors have to be available on a fairly regular basis. Tutors are normally members of the teaching staff, but may, in certain circumstances, be students who have previously completed the unit successfully. Thus, the possibility of *peer teaching* can be incorporated into a Keller Plan approach.

When a student feels that he has mastered a given unit, i.e. feels he has achieved all the objectives set, he presents himself for a test (which may be oral or written) and this test must be passed at a predetermined level before going on to the next unit. In most Keller Plan courses, a high degree of mastery is required, and pass marks on tests may be of the order of 80–90%. There is, however, no penalty for failing, and students may attempt tests on a given unit as many times as is necessary. After each test, the student and tutor discuss any problems which may have arisen during work on the unit or during the term itself.

In Keller Plan, lectures (although not a main element of the teaching) are sometimes used to provide an overview of the course material or to illuminate certain aspects of the topics studied. Laboratory work (if required) is normally carried out under the direct supervision of a laboratory assistant.

The basic Keller Plan approach has been modified and adapted to meet a wide variety of needs. Peer teaching is not always used, tests may be included on *groups* of units, a high level of mastery is not always required, and the final grades can be decided using different methods. Whatever the variations, however, the essential elements of Keller Plan are *individualised learning, independent study* and *self–(i.e. student–) pacing*. Although Keller Plan has been used with a wide range of subjects, the most common applications to date have been with medical and science subjects, usually at college or university level.

Use of individualised learning
in a flexible–learning or open–learning system

Another area in which individualised learning can play a major role is in courses that are organised on a *flexible–learning* or *open–learning* basis. Here, a host institution makes a course available to members of the local community on a highly flexible basis, students being able to attend the college at times that suit themselves rather than the college, and carrying out most of their work using individualised learning materials of various types – often made available via a *resources centre* or *learning–by–appointment* scheme of some sort. The students on such a course are normally also provided with tutorial support and access to specialised facilities (such as library, computer and laboratory facilities) by making appropriate arrangements with the college staff concerned. With the current move towards regarding education as an on–going activity that continues throughout a person's life rather than a once–off package provided before he or she enters employment, such courses seem certain to become more and more common during the next decade.

Use of individualised learning in distance learning systems

Another type of system in which individualised learning invariably plays a major role is *distance learning*. This differs from a conventional in-college course or open-learning course in that most of the learning takes place away from the host institution. The latter provides the students with individualised learning materials that cover the bulk of the basic content, either by sending them through the post or by making use of radio or television broadcasts or (in recent years) cable television distribution systems. The host institution also generally provides tutorial help and support, either by correspondence or telephone or through local tutors. Probably the best known example of a distance learning system of this type is the *Open University*. Like flexible-learning and open-learning courses, distance learning courses seem certain to become more and more common as the perceived role of education in society changes.

Use of individualised learning packages for equalisation and remedial purposes

Quite apart from their use in teaching the mainline curricular content of courses of various types, individualised learning materials can play a major role in the *pre-entry work* and *remedial work* that is often required in respect of such courses. By *pre-entry work*, we mean providing students who lack some of the skills or knowledge needed to enable them to embark on a particular course, module, etc with supplementary instruction designed to help them acquire such skills or knowledge. By *remedial work* , we mean providing students who have failed to master some of the material in a course with personalised supplementary instruction designed to help them to do so. In both cases, the most effective way of providing students with the necessary supplementary instruction may well be via the use of individualised learning packages specially designed for the purpose, especially as the use of such packages also allows the students to work at their own pace and in their own time and makes it unnecessary for extra classes to be fitted into what may already be a full curriculum. Indeed, with the current moves towards more flexible entry standards in respect of further and higher education courses, its use in providing equalisation and remedial instruction of this type may well turn out to be one of the most important uses of individualised learning.

Further Reading

1. *A Handbook of Educational Technology*, by F Percival and H I Ellington; Kogan Page, London; 1984. (This introductory text on the principles and practice of educational technology

deals with the topics of student-centred learning and individualised learning in some detail; it also contains a comprehensive bibliography that lists a wide range of useful books and articles on the two topics).

2. *Individualised Learning* (*Aspects of Educational Technology X*), edited by J Clarke and J Leedham; Kogan Page, London; 1976. (The proceedings of the 1976 ETIC Conference, whose theme was individualised learning; a rich collection of papers on virtually all aspects of the subject.)

3. *Teaching through Self-instruction*, by D Rowntree; Kogan Page, London; 1986. (An extremely useful basic text on the field written for the practising teacher; highly recommended.)

4. *Developing Student Autonomy in Learning*, edited by D Baird; Kogan Page, London; 1981. (An extremely influential book containing articles and issues, case studies and reflections related to a range of approaches to independent learning; also highly recommended.)

5. *How to Develop Self-instructional Teaching* – A Self-instructional Guide to the Writing of Self-instructional Materials, edited by D Rowntree and B Conners; The Open University, Milton Keynes; 1980. (Self-explanatory!)

6. *Programmed Learning: Writing a Programme*, by J Megarry; Jordanhill College of Education, Glasgow; 1978. (An inexpensive booklet that provides the beginner with a sound introduction to the design of programmed materials.)